

DOSE EFFECTS ON MECHANICAL PROPERTIES OF γ - IRRADIATED POLYDIMETHYLSILOXANE

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Elastomers find applications when they are vulcanized. The vulcanization induced by ionising radiation (γ -rays, X-rays or electron beam) occurs at room temperature, in air presence and without peroxides or catalysts which is a purer process so that it can be applied in the health area. γ -radiation effect on polydimethylsiloxane has been studied to see mechanical properties alteration as consequence of crosslinking or scission reactions considering the vulcanization study and the possibility of making medical devices radiosterilization. Polydimethylsiloxane with 4% vinyl groups, 23% fumed silica as reinforcing agent and additives was irradiated by γ -rays from ^{60}Co source (dose rate = 1,0 kGy/h) at room temperature and in air presence and dose range from 12 to 300 kGy. Mechanical properties measurements including shore A hardness (SAH), tensile strength at break (TS), ultimate elongation at break (UE) and tear strength (TES) were made. Could be observed that TS increases until 70 kGy and then decreases while UE always decreases. SAH highly increases up to 25 kGy and TES always decreases. γ -rays alter all the mechanical properties studied on the range of 0 - 300 kGy. When the application is considered, it is important to note that UE always decreases with dose increase while SAH and TS increase as foreseen by the theory ⁽¹⁾ where the work of fracture for elastomers decreases with the decrease of $M_c^{1/2}$ and $E^{-1/2}$. M_c is molecular weight between points of molecular interlinking and E is the tensile modulus of elasticity which depends on the crosslinking density. These experimental observations show the necessity of defining the best dose to each polydimethylsiloxane vulcanized application, where a set of properties together must be the most appropriate.

⁽¹⁾ GENT, A. N. The influence of chemical structure on the strength of rubber. In: LAL, J. & MARK, J. E. *Advances in elastomers and rubber elasticity*. Plenum press, New York, 1986, pp. 253 - 267.